

WHAT IS CLAIMED IS:

1           1.     A method of adjusting a voice prompt of a system based upon a state of a  
2 user of the system, the method comprising:

3                   receiving an utterance of the user;

4                   obtaining utterance parameters from the utterance, the utterance

5                   parameters indicating the state of the user;

6                   determining the state of the user based upon the utterance parameters; and

7                   adjusting the voice prompt by adjusting at least one of a tone of voice of

8                   the voice prompt, a content of the voice prompt, a prosody of the

9                   voice prompt, and a gender of the voice prompt based upon the

10                  determined state of the user.

1           2.     The method of claim 1, wherein obtaining utterance parameters comprises:

2                   partitioning the utterance into segments; and

3                   assigning one of a plurality of classifications to each segment, each

4                   classification corresponding to at least one of a plurality of states

5                   of the user.

1           3.     The method of claim 1, wherein determining the state of the user

2 comprises:

3                   generating an utterance parameter vector based upon the utterance

4                   parameters;

5                   converting the utterance parameter vector to an indication representing the  
6                   state of the user; and  
7                   determining the state of the user based upon the indication.

1           4.       The method of claim 3, wherein generating the utterance parameter vector  
2 comprises:

3                   determining the number of segments for each classification; and  
4                   dividing the number of segments for each classification by a total number  
5                   of segments in the utterance.

1           5.       The method of claim 3, wherein converting the utterance parameter vector  
2 to an indication comprises applying a function to the utterance parameter vector to  
3 generate one of a scalar, a vector of fuzzy classes, and an index representing the state of  
4 the user.

1           6.       The method of claim 5, wherein the indication is the scalar and  
2 determining the state of the user based upon the indication comprises determining that the  
3 user is in a first state if the scalar is greater than a predetermined threshold and that the  
4 user is in a second state if the scalar is not greater than the predetermined threshold.

1           7.       The method of claim 1, wherein adjusting the voice prompt comprises  
2 adjusting the tone of the voice prompt to use a tone that is consistent with the determined  
3 state of the user.

1           8.       The method of claim 1, wherein adjusting the voice prompt comprises  
2     adjusting the content of the voice prompt to use content that is consistent with the  
3     determined state of the user.

1           9.       The method of claim 1, wherein adjusting the voice prompt comprises  
2     adjusting the gender of the voice prompt to use a gender that is consistent with the  
3     determined state of the user.

1           10.      The method of claim 1, wherein adjusting the voice prompt comprises  
2     adjusting the prosody of the voice prompt to use prosody that is consistent with the  
3     determined state of the user.

1           11.      The method of claim 10, wherein adjusting the prosody of the voice  
2     prompt comprises pausing the voice prompt.

1           12.      The method of claim 1, wherein the system is an on-board computer used  
2     in an automobile or a navigation system used in an automobile.

1           13.      The method of claim 12, further comprising receiving information on a  
2     driving condition from the on-board computer or the navigation system and determining  
3     the state of the user based upon the information on driving condition.

1           14.      The method of claim 1, further comprising adjusting a graphical character  
2     display corresponding to the voice prompt based upon the determined state of the user.

1           15.      A method of adjusting a voice prompt of a system based upon a state of a  
2     user of the system, the method comprising:

3 receiving an utterance of the user;  
4 obtaining utterance parameters from the utterance, the utterance  
5 parameters indicating the state of the user;  
6 generating an utterance parameter vector based upon the obtained  
7 utterance parameters;  
8 converting the utterance parameter vector to an indication representing the  
9 state of the user;  
10 determining the state of the user based upon the indication; and  
11 adjusting the voice prompt based upon the determined state of the user.

1 16. The method of claim 15, wherein obtaining utterance parameters  
2 comprises:  
3 partitioning the utterance into segments; and  
4 assigning one of a plurality of classifications to each segment, each  
5 classification corresponding to at least one of a plurality of states  
6 of the user.

1 17. The method of claim 15, wherein generating the utterance parameter  
2 vector comprises:  
3 determining the number of segments for each classification; and  
4 dividing the number of segments for each classification by a total number  
5 of segments in the utterance.

1 18. The method of claim 15, wherein converting the utterance parameter  
2 vector to the indication comprises applying a function to the utterance parameter vector

3 to generate one of a scalar, a vector of fuzzy classes, and an index representing the state  
4 of the user.

1 19. The method of claim 18, wherein the indication is the scalar and  
2 determining the state of the user based upon the scalar comprises determining that the  
3 user is in a first state if the scalar is greater than a predetermined threshold and that the  
4 user is in a second state if the scalar is not greater than the predetermined threshold.

1 20. The method of claim 15, wherein adjusting the voice prompt comprises  
2 adjusting the tone of the voice prompt to use a tone that is consistent with the determined  
3 state of the user.

1 21. The method of claim 15, wherein adjusting the voice prompt comprises  
2 adjusting the content of the voice prompt to use content that is consistent with the  
3 determined state of the user.

1 22. The method of claim 15, wherein adjusting the voice prompt comprises  
2 adjusting the gender of the voice prompt to use a gender that is consistent with the  
3 determined state of the user.

1 23. The method of claim 15, wherein adjusting the voice prompt comprises  
2 adjusting the prosody of the voice prompt to use prosody that is consistent with the  
3 determined state of the user.

1 24. The method of claim 23, wherein adjusting the prosody of the voice  
2 prompt comprises pausing the voice prompt.

1           25.    The method of claim 15, wherein the system is an on-board computer used  
2   in an automobile or a navigation system used in an automobile.

1           26.    The method of claim 25, further comprising receiving information on a  
2   driving condition from the on-board computer or the navigation system and determining  
3   the state of the user based upon the information on driving condition.

1           27.    The method of claim 15, further comprising adjusting a graphical  
2   character display corresponding to the voice prompt based upon the determined state of  
3   the user.

1           28.    A system adjusting a voice prompt based upon a state of a user of the  
2   system, the system comprising:

3                   a signal processing module for obtaining utterance parameters from  
4                   utterance received from the user, the utterance parameters  
5                   indicating the state of the user;

6                   an utterance parameter vector generation module for generating an  
7                   utterance parameter vector based upon the obtained utterance  
8                   parameters;

9                   a user state determination module for converting the utterance parameter  
10                  vector to an indication representing the state of the user and

11                  determining the state of the user based upon the indication; and

12                  a speech waveform storage module for selecting an audio waveform for  
13                  the voice prompt based upon the determined state of the user.

1           29.    The system of claim 28, wherein the signal processing module obtains the  
2 utterance parameters by:

3                   partitioning the utterance into segments; and  
4                   assigning one of a plurality of classifications to each segment, each  
5                   classification corresponding to at least one of a plurality of states  
6                   of the user.

1           30.    The system of claim 28, wherein the utterance parameter vector generation  
2 module generates the utterance parameter vector by:

3                   determining the number of segments for each classification; and  
4                   dividing the number of segments for each classification by a total number  
5                   of segments in the utterance.

1           31.    The system of claim 28, wherein the user state determination module  
2 converts the utterance parameter vector to the indication by applying a function to the  
3 utterance parameter vector to generate one of a scalar, a vector of fuzzy classes, and an  
4 index representing the state of the user.

1           32.    The system of claim 31, wherein the indication is the scalar and the user  
2 state determination module determines that the user is in a first state if the scalar is  
3 greater than a predetermined threshold and that the user is in a second state if the scalar is  
4 not greater than the predetermined threshold.

1           33.     The system of claim 28, wherein the speech waveform storage module  
2     selects the audio waveform of the voice prompt having a tone that is consistent with the  
3     determined state of the user.

1           34.     The system of claim 28, wherein the speech waveform storage module  
2     selects the audio waveform of the voice prompt having content that is consistent with the  
3     determined state of the user.

1           35.     The system of claim 28, wherein the speech waveform storage module  
2     selects the audio waveform of the voice prompt of a gender that is consistent with the  
3     determined state of the user.

1           36.     The system of claim 28, wherein the speech waveform storage module  
2     selects the audio waveform of the voice prompt having prosody that is consistent with the  
3     determined state of the user.

1           37.     The system of claim 28, wherein the system is an on-board computer used  
2     in an automobile or a navigation system used in an automobile.

1           38.     The system of claim 37, wherein the user state determination module  
2     receives information on a driving condition from the on-board computer or the navigation  
3     system and determines the state of the user based upon the information on driving  
4     condition.



1           39.     The system of claim 28, further comprising a display device for displaying  
2     a graphical character corresponding to the voice prompt to the user, the displayed  
3     graphical character being adjusted based upon the determined state of the user.

1           40.     A system adjusting a voice prompt based upon a state of a user of the  
2     system, the system comprising:  
3                 a signal processing module for obtaining utterance parameters from  
4                         utterance received from the user, the utterance parameters  
5                         indicating the state of the user;  
6                 an utterance parameter vector generation module for generating an  
7                         utterance parameter vector based upon the obtained utterance  
8                         parameters;  
9                 a user state determination module for converting the utterance parameter  
10                         vector to an indication representing the state of the user and  
11                         determining the state of the user based upon the indication; and  
12                 a speech synthesizer module for generating an audio waveform of the  
13                         voice prompt based upon the determined state of the user.

1           41.     The system of claim 40, wherein the signal processing module obtains the  
2     utterance parameters by:  
3                 partitioning the utterance into segments; and  
4                 assigning one of a plurality of classifications to each segment, each  
5                         classification corresponding to at least one of a plurality of states  
6                         of the user.

1           42.    The system of claim 40, wherein the utterance parameter vector generation  
2 module generates the utterance parameter vector by:

3                   determining the number of segments for each classification; and

4                   dividing the number of segments for each classification by a total number  
5                   of segments in the utterance.

1           43.    The system of claim 40, wherein the user state determination module  
2 converts the utterance parameter vector to the indication by applying a function to the  
3 utterance parameter vector to generate one of a scalar, a vector of fuzzy classes, and an  
4 index representing the state of the user.

1           44    The system of claim 43, wherein the indication is the scalar and the user  
2 state determination module determines that the user is in a first state if the scalar is  
3 greater than a predetermined threshold and that the user is in a second state if the scalar is  
4 not greater than the predetermined threshold.

1           45.    The system of claim 40, wherein the speech synthesizer module generates  
2 the audio waveform of the voice prompt to have a tone that is consistent with the  
3 determined state of the user.

1           46.    The system of claim 40, wherein the speech synthesizer module generates  
2 the audio waveform of the voice prompt based upon content that is consistent with the  
3 determined state of the user.

1           47.     The system of claim 40, wherein the speech synthesizer module generates  
2     the audio waveform of the voice prompt to be of a gender that is consistent with the  
3     determined state of the user.

1           48.     The system of claim 40, wherein the speech synthesizer module generates  
2     the audio waveform of the voice prompt having prosody that is consistent with the  
3     determined state of the user.

1           49.     The system of claim 40, further comprising a speech storage module  
2     storing speech and outputting speech that is consistent with the determined state of the  
3     user to the speech synthesizer module.

1           50.     The system of claim 40, wherein the system is an on-board computer used  
2     in an automobile or a navigation system used in an automobile.

1           51.     The system of claim 50, wherein the user state determination module  
2     receives information on a driving condition from the on-board computer or the navigation  
3     system and determines the state of the user based upon the information on driving  
4     condition.

1           52.     The system of claim 40, further comprising a display device for displaying  
2     a graphical character corresponding to the voice prompt to the user, the displayed  
3     graphical character being adjusted based upon the determined state of the user.

1           53.     A system adjusting a voice prompt based upon a state of a user of the  
2     system, the method comprising:

3 means for obtaining utterance parameters from utterance received from the  
4 user, the utterance parameters indicating the state of the user;  
5 means for determining the state of the user based upon the utterance  
6 parameters; and  
7 means for adjusting the voice prompt by adjusting at least one of a tone of  
8 voice of the voice prompt, a content of the voice prompt, a prosody  
9 of the voice prompt, and a gender of the voice prompt based upon  
10 the determined state of the user.

1 54. The system of claim 53, wherein the means for determining the state of the  
2 user based upon the utterance comprises:

3 means for generating an utterance parameter vector based upon the  
4 utterance parameters;  
5 means for converting the utterance parameter vector to an indication  
6 representing the state of the user; and  
7 means for determining the state of the user based upon the indication.

1 55. The system of claim 54, wherein the means for converting the utterance  
2 parameter vector to the indication applies a function to the utterance parameter vector to  
3 generate one of a scalar, a vector of fuzzy classes, and an index representing the state of  
4 the user.

1 56. The system of claim 55, wherein the indication is the scalar and the means  
2 for determining the state of the user based upon the indication determines that the user is

3 in a first state if the scalar is greater than a predetermined threshold and that the user is in  
4 a second state if the scalar is not greater than the predetermined threshold.

1 57. The system of claim 53, wherein the means for adjusting the voice prompt  
2 adjusts the tone of the voice prompt to use a tone that is consistent with the determined  
3 state of the user.

1 58. The system of claim 53, wherein the means for adjusting the voice prompt  
2 adjusts the content of the voice prompt to use content that is consistent with the  
3 determined state of the user.

1 59. The system of claim 53, wherein the means for adjusting the voice prompt  
2 adjusts the gender of the voice prompt to use a gender that is consistent with the  
3 determined state of the user.

1 60. The system of claim 53, wherein the means for adjusting the voice prompt  
2 adjusts the prosody of the voice prompt to use prosody that is consistent with the  
3 determined state of the user.

1 61. The system of claim 53, wherein the system is an on-board computer used  
2 in an automobile or a navigation system used in an automobile.